PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Biological Monitoring Of Columbia River Basin Salmonids

BPA project number: 20542
Contract renewal date (mm/yyyy): ☒ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Multi-agency: recommendation for continued biological smolt monitoring

Business acronym (if appropriate)

Proposal contact person or principal investigator:

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NPPC Program Measure Number(s) which this project addresses
4.2, 4.3, 5.0, 5.1, 5.2, 5.3, 5.4, 5.5, (6.0), 7.1C, 7.2, 7.4, 7.5,

FWS/NMFS Biological Opinion Number(s) which this project addresses
NMFS Hydrosystems Operations Biological Opinion, Endangered Species Acts listings of Columbia basin salmonid species, NMFS Recovery Plan for Snake.

Other planning document references

The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes

Short description
Systemwide coordination of monitoring of salmonid biology is needed to allow informed modifications as basin managers adapt breeding, rearing and habitat, and passage programs to declining stocks, and hydrosystem and climatic change.

Target species
salmonids species: Oncorhynchus spp.

Section 2. Sorting and evaluation

Subbasin
Systemwide

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories
☒ Anadromous fish ☐ Resident fish ☐ Wildlife	☒ Multi-year (milestone-based evaluation) ☐ Watershed project evaluation	☐ Watershed councils/model watersheds ☒ Information dissemination ☐ Operation & maintenance ☐ New construction ☒ Research & monitoring ☒ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description
20552	Smolt Monitoring Program
20542	Biological Monitoring of Columbia Basin Salmonids

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
				Total	0.00%

Schedule constraints

Completion date

Section 5. Budget

FY99 project budget (BPA obligated):

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel		%0	
Fringe benefits		%0	
Supplies, materials, non-expendable property		%0	
Operations & maintenance		%0	
Capital acquisitions or		%0	

improvements (e.g. land, buildings, major equip.)			
NEPA costs		%0	
Construction-related support		%0	
PIT tags	# of tags:	%0	
Travel		%0	
Indirect costs		%0	
Subcontractor		%0	
Other		%0	
TOTAL BPA FY2000 BUDGET REQUEST			$ 0

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
		%0	
		%0	
		%0	
		%0	
Total project cost (including BPA portion)			$ 0

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget				

Section 6. References

Watershed?	Reference
☐	
☐	
☐	
☐	

PART II - NARRATIVE

Section 7. Abstract

The Biological Monitoring of Columbia Basin Salmonids umbrella proposal groups the juvenile salmonid management projects in the basin to describe common objectives. The approach should be considered systemwide because the anadromous life history of the

stocks extends through the entire Columbia basin during the juvenile and adult migrations when basin stocks interact. Species and stock specific attributes such as difference in the time of emergence, phasing and magnitude of smolt development, differences in migration times and length of ocean residence, all support the present subbasin or watershed approach to individual stock management, to be combined with a systemwide comparison of migration data. A combined subbasin and systemwide coordination approach would cover monitoring and evaluation from emergence, through rearing and migration, estuary survival, ocean residence, and the adult migration through spawning. Extensive efforts to improve juvenile salmonid condition and survival are being conducted basinwide. An adequate centralized program for enumerative and migration survival data presently exists, but it is not accompanied by consistent monitoring of salmonid migration biology. The umbrella proposal is a recommendation that a systemwide approach be applied to biological monitoring and evaluation that could be included in the ISRP recommended Smolt Monitoring Projects umbrella. This umbrella proposal supports a systemwide approach to salmonid management to facilitate annual information exchange and adaptive management of Columbia basin salmonids in a timely manner at this critical period for many basin stocks.

Section 8. Project description

a. Technical and/or scientific background

The umbrella project unifies related projects that evaluate juvenile salmonid performance but includes adult survival as necessary component. The projects are already associated by a history of cooperation and information sharing from earlier Fish Passage Center and interagency (state, federal, tribal, utility) monitoring programs that evaluated juvenile salmonid condition at hatcheries and during the migration. Numerous projects funded by the BPA, COE, USFWS, state, tribal, private, and utility agencies are committed to salmonid survival. The agency approach has been to concentrate efforts on very specific problems such as declining stocks in an individual watershed, stock reintroductions, and passage at a particular dam. A performance measurement for these management actions has been an anticipated change in the migration success of the affected stocks. If change has been accomplished, then the assumption may be made that the nature and composition of the Columbia basin salmonid migration has changed. While the program to enumerate fish passage, and estimate survival may easily adapt to changes in the migration profile, no program documents the accompanying biological changes within the migration populations that interact with the environment to change migration behavior.

An example of a systemwide approach:

Investigation of Regional Changes in Smolt Condition for Managing Releases, Passage, and Transport to Improve Juvenile Salmonid Survival

Goal: The goal of the project is to provide regional biological monitoring of juvenile salmonid condition to evaluate and predict performance during migration on a system wide level. Adaptive modifications of guidance, collection, passage, and transport methods are being made as hydroelectric operations, in combination with climatic variation, change conditions of flow, spill, velocity, and temperature. The Columbia River and its tributaries have been extensively modified by hydroelectric dams, changing the configuration of the river to one of a series of reservoirs. The physiology of juvenile and adult salmonids determines their behavior during migration in response to flow. The project would coordinate with federal, state, and tribal hatcheries and project managers to select reference stocks to provide a consistent measure of the interaction of changing river conditions with the physiological condition of migrants. Biological monitoring would identify systems modification that influence the run-at-large. The information from selected monitoring sites would provide critical physiological information for predicting the effects of new management strategies such as drawdown on juvenile migration and adult returns, based on a consistent, unbroken record of physiological condition and documented performance of reference stocks. A system wide program is needed to identify the cumulative effects of changes in river condition on migration success of the run-at-large. This information would be applied to modification of the timing and methods of release, collection, by-pass, and transportation programs to improve survival of juveniles and increase adult returns.

Past smolt monitoring programs will be reviewed and will provide migration profiles of selected reference stocks in the context of annual differences in river condition. Reference stocks will be selected from existing production programs by critical review of project design and a determination of basin wide significance. An annual characterization of the juvenile salmonid migration in the Columbia and Snake Rivers for identification of hydrosystem modifications and climatic factors affecting annual variations in river conditions, juvenile survival, and adult returns. Methods that allow evaluation of large numbers of fish with no affect on survival will be used. The project will provide analysis of annual changes in smoltification to managers for adaptive modification and scheduling of release, transport, and passage programs to optimize juvenile survival and adult returns.

The Monitoring and Evaluation Program outlined in the 1995 Biological Opinion Operational Requirements, Objectives, and Actual Performance proposes a comprehensive program to monitor juvenile salmonids in relation to the amount and timing of flows, spill, and dam operations, with resultant changes in temperatures and dissolved gas levels. Present research projects investigate performance in single reaches or transport areas, or focus on gas bubble trauma. A systematic method for evaluating the effect of any single system modification on the migration as a whole is needed.

Currently funded research projects emphasize the effects of collection, passage, and transport design on the survival of fish of unknown condition, rather than the effects of fish condition on performance and survival under conditions of known flow, spill, and temperature. The proposed research establishes a centralized smolt monitoring program

to provide annual and long term evaluation of the juvenile migration using representative stocks. The program will provide uniform sampling and analysis capabilities to a large number of research projects, with a centralized system for long term investigation of the effects of regional changes in smolt condition on survival at Columbia River system dams.

Artificial production practices in the Columbia basin are changing rapidly as fish numbers decline, and regional fishery agencies modify their programs to improve juvenile survival during migration. Several key strategies have emerged, including off-site and serial releases from hatcheries, natural rearing efforts at artificial production facilities, captive brood stock programs, and incorporation of wild/natural fish into production broodstock. One or any combination of these management measures has the potential of producing fish physiologically different from existing hatchery stocks produced solely from adult returns to the hatchery. Future releases will include wild/hatchery crosses that may exhibit different migration patterns, rates, and survival based on altered physiological condition that requires modification of existing management practices. Of greatest concern is the effect of smolt condition and health on survival during passage and transportation. The proposed research would incorporate existing artificial production research and management programs into the Anadromous Fish Evaluation Program, and fulfill requirements of the Monitoring and Evaluation Program of the 1995 Biological Opinion, by providing centralized physiological monitoring capabilities to stocks affected by the Federal Columbia River Power System.

The proposed biological monitoring program is related to all current research projects involving juvenile salmonids, their behavior and performance during migration, and subsequent adult returns. The interaction of juvenile salmonid condition with environmental variables, especially the physical design and configuration of hydropower facilities, needs to be investigated in light of region wide changes in river management and artificial production. Selected reference stocks and sites will provide continuous monitoring and evaluation of management changes for a system wide reference for future adaptive changes.

b. Rationale and significance to Regional Programs

The rationale and significance to Regional Programs and consideration as a Systemwide project is clear from the geographic range that the anadromous stocks occupy during their life history. Projects that have worked together and that will be included under the Juvenile Salmonid umbrella proposal are found in proposed umbrella categories such as the Northeast Oregon Hatchery Projects, Smolt Monitoring Projects, Fall Chinook Research Projects, and Supplementation Research Projects. Other funding of evaluation activities comes from the Snake River Compensation Plan, Mitchell Act funds, utility and tribal fishery programs, and agency programs. The rationale for uniform standards of evaluation of smoltification is to provide consistent monitoring and evaluation efforts for all projects, and for information transfer among Columbia Basin projects. Performance measurements that are meaningful at all stages of juvenile and adult develop regardless of location, time of year, or management activity are necessary to allow continued modification of management activities that affect juvenile condition and adult survival. Subbasin efforts are necessary to evaluate how stock and environmental differences contribute to differences seen among species, or stocks of the same species, but a systemwide approach is needed for the long period when Columbia basin stocks interact.

c. Relationships to other projects

d. Project history (for ongoing projects)

e. Proposal objectives

Objectives: A regional program will be established to provide standardized physiological information to passage and transport managers, artificial production, and fishery management agencies. The investigation will evaluate physiological data on a system wide basis providing a regional analysis of performance incorporating production, passage, transport, and survival information.
Propose to: 1) meet with regional production and fishery managers to select reference stocks, 2) meet with passage and transport, regional production and fishery managers to select passage facilities, 3) coordinate with current marking programs to use marked fish for identification for sampling, 4) establish a sampling program during the juvenile migration, 5) analyze and interpret physiological data, and 6) provide an evaluation of data to regional fish managers for migration management.

Objective 1. Select reference stocks for monitoring program in cooperation with regional production and fishery managers.

Current trends in salmonid stock management in the Columbia basin emphasize incorporation of wild or natural fish into hatchery broodstock programs, captive broodstock programs, serial releases of fish, and production methods to produce releases with characteristics of wild fish. Both artificial production and wild fishery managers recognize the effects these practices may have on fish condition, and therefore survival. Populations with critically low numbers would doubtlessly be those most affected by changes in management methods. We propose that initially, a single stock representative of each salmonid species be selected cooperatively for both the mid-Columbia and Snake Rivers.

Objective 2. Select passage facilities to be designated monitoring sites.

Monitoring sites will be selected based on collection efficiency. Juvenile and adult guidance, collection, passage, and transportation programs will be reviewed to select facilities where collections will best represent the run-at-large.

Objective 3. Coordinate with current marking programs to use marked fish for identification for sampling.

Marking programs of the selected stocks will be used for identification purposes of reference stocks.

Objective 4. Establish sampling program during run-at-large.

Sampling will be conducted three times before release, or in the case of wild stocks during marking. Sampling activities at juvenile passage facilities will run as long as fish from the reference stocks are known to pass the facility. Temporary staff will be trained for the passage facility positions, and will also travel to, and sample at the reference hatchery or field sites for the pre-migration sampling. Review of past fish passage records will establish the duration of sampling for the selected stocks. Records will be analyzed with adult returns for reference stocks.

Objective 5. Sample, analyze, and evaluate physiological data.

Objective 6. Provide evaluation of data to regional fish managers for migration management. A coordinated program of information dissemination and discussion will be developed to provide annual evaluations of regional change in smolt condition, migration patterns, and smolt-to-adult survival.

Results of the investigation will provide supplemental, relevant migration information to other proposed studies for the evaluation of collection, passage, and transportation. Our investigation will provide the baseline, physiological measurements of fish condition and health that determine performance during migration. Presently, no project exists that provides a basin wide perspective on the changing nature of the interaction between

Columbia River salmonids and river conditions as determined by hydroelectric operations and annual climatic change.

f. Methods

Methods: Sampling sites will be established at one mid-Columbia River, one Snake River, and one mainstem Columbia River dam. The program may be incrementally established beginning with Snake River system in anticipation of the proposed drawdown. Reference stocks will be selected by considering established management projects using tagged fish that will provide at least three years of data with adult return. Stocks will be selected to provide evaluation of projects representing the following management programs: 1) design changes in passage facilities or transportation methods, 2) serial releases at hatcheries, 3) captive brood stock programs, and 4) incorporation of wild or naturalized fish into hatchery broodstock and 5) any wild stocks included in marking programs. Physiological monitoring would include non-lethal measurements including length and weight; reflectance, body morphology, and total body fat analysis for smolt assessment, and measures of non-specific immunity for health assessment. Analysis of variance (ANOVA) will test for differences in physiological measurements between sample sites in the individual reference stocks. Data analysis will combine physiological data with river conditions to determine optimal release, transport, and passage protocols.

g. Facilities and equipment

h. Budget

Section 9. Key personnel

Section 10. Information/technology transfer

Technology Transfer

Data collected during this investigation will provide predictive and diagnostic evaluations of the migration by monitoring the biology of reference stocks that will act an indicator of changes in migration patterns and success under current and proposed

management activities. The data will provide a regional perspective for planning and implementing fishery or system modifications that may have unforeseen consequences at other points in the migration. The data should be incorporated with enumerative and survival data complied by the FPC, and would provide baseline and background reference levels of fish condition for comparison with smaller projects operating in limited areas. Information will be distributed as preliminary reports, annual reports, and a comprehensive database.

Congratulations!